

**DETAILED ACTION**

***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 10/14/2011 has been entered.

***Claim Rejections - 35 USC § 103***

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 25, 31, 32 and 34-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Winsor et al (GB 1,144,498) ("Winsor") in view of Brahma et al (US Patent 5,482,616) ("Brahma"), Bailey et al (US Patent 4,634,515) ("Bailey") and Kimber et al (US Patent 5,059,539) ("Kimber").

4. With respect to claim 25, Winsor discloses a process for the removal of thiophenic sulfur compounds from aromatic hydrocarbons (See page 1, lines 10-13; page 2, lines 9-10, 14-15). The process comprises: contacting the feed stock in presence of hydrogen with a sulfided nickel adsorbent (See page 1, lines 23-36, 60-61).

Winsor invention also discloses a partially sulfided nickel contact material having 10 wt% elemental nickel (See page 2, lines 53-56; page 4, lines 7-15) showing high

sulfur capacity, prolonged activity (for 1300 hours) and substantially no hydrogenation activity (See page 4, lines 21-27).

Winsor further discloses an atomic ratio of S to Ni in a range including as claimed (See page 4 Table 1). Winsor also discloses contacting the feedstock with metal oxides (cobalt and molybdenum oxides) for the removal of contaminating sulfur compounds before using the sulfided nickel adsorbent from the hydrocarbon feedstock (See page 2, lines 30-45). It is to be noted that cobalt and molybdenum oxides upon reaction with sulfur compounds, will form stable sulfides.

Winsor invention does not specifically disclose rate constant for tetralin hydrogenation activity of the adsorbent, however, the invention does disclose that the supported nickel used in the invention does not show appreciable hydrogenation of the aromatic hydrocarbons (See page 1, lines 50-54). This indicates that the supported nickel in the Winsor process has very low value of the rate constant. It is to be noted that rate constant for hydrogenation activity for an adsorbent or catalyst is a property which can be easily determined.

Kimber discloses test for catalyst activity in which naphthalene is reversibly hydrogenated (See abstract). Kimber elaborately discloses method of measuring catalyst activity for hydrogenation (See column 1, lines 49-68; column 2, lines 1-38).

In view of Kimber teaching, it would have been obvious to one with ordinary skill in the art at the time the invention was made to modify Winsor invention and determine the tetralin hydrogenation activity for the adsorbent used in the invention because tetralin hydrogenation and naphthalene hydrogenation processes are expected to be

similar. It is expected that the rate constant in Winsor invention will be in a range as claimed by the Applicant because Winsor is using an adsorbent similar to the Applicant's claim.

Winsor also discloses that more than one stage of desulfurization using nickel adsorbent can be used (See page 2, lines 30-41). This indicates that the metal oxides (cobalt and molybdenum oxides) are also desulfurization agents which could be combined with the nickel adsorbent by one skilled in the art.

Brahma discloses a catalyst system having a nickel component on a support and a metal oxide component and using the said catalyst system in a process for hydrogenation of a hydrocarbon feedstock (See abstract; column 1, lines 62-67; column 2, lines 1-3, 44-53, 60-63; column 3, lines 3-9, 59-67; column 4, lines 53-64). Brahma also discloses that the particles of metal oxide containing component and the particles of hydrogenation component can be applied to the same support material or onto different support materials and which are then mixed with each other (See column 4, lines 4-9).

Bailey discloses a nickel adsorbent for sulfur removal from hydrocarbon streams (See title; abstract) similar to Winsor. Bailey also discloses use of a commercially available nickel hydrogenation catalyst as sulfur adsorbent (See Examples 1-2, column 5; Example 5, column 5). Thus, Bailey is evidence that the nickel adsorbent used in Brahma invention is also a desulfurization adsorbent.

In view of Winsor's use of a bed of metal oxide followed by a bed of the nickel adsorbent, Bailey's teaching that a nickel hydrogenation catalyst can also be used as a

sulfur adsorbent, and Brahma's teaching of using nickel and metal oxide either on the same support or on different supports and physically mixed, it would have been obvious to one with ordinary skill in the art at the time the invention was made to modify Winsor invention and use the metal oxides along with nickel adsorbent for an enhanced desulfurization effect. According to MPEP, "It is *prima facie* obvious to combine two compositions each of which is taught by the prior art to be useful for the same purpose, in order to form a third composition to be used for the very same purpose". *In re Kerkhoven*, 626 F.2d 846, 850, 205 USPQ 1069, 1072 (CCPA 1980).

5. With respect to claims 31 and 32, Winsor invention discloses temperature between 50 and 316°C (See Table: page 2, between lines 59 and 60). Winsor invention also discloses using a fixed bed process (See page 2, lines 93-97; page 3, lines 1-5).

6. With respect to claims 34-40, Winsor invention discloses pressure from 0 to 2000 psig (0 to 138 bar), temperature between 50 and 316°C and liquid hourly space velocity between 0.05 to 10 hr<sup>-1</sup> (See page 2, Table between lines 59 and 60). This indicates that hydrogen partial pressure is expected to be in a range as claimed. Winsor also discloses hydrogen/hydrocarbon ratio in the feed (See page 2, Table between lines 59 and 60). Knowing the total hydrogen flow rate per unit catalyst volume, one with ordinary skill in the art could determine the gas hourly space velocity (GHSV). It is expected that Winsor invention is using a GHSV in the claimed range because the invention is using the LHSV in the claimed range.

7. Claims 26-30, 33 and 41-47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Winsor et al (GB 1,144,498) ("Winsor") in view of Brahma et al (US Patent 5,482,616) ("Brahma"), Bailey et al (US Patent 4,634,515) ("Bailey"), Kimber et al (US Patent 5,059,539) ("Kimber") and further in view of Bouwman et al (US Patent 5,223,470) ("Bouwman") and Archibald (US Patent 2,951,034) ("Archibald").

8. With respect to claims 26-28, 41, 46 and 47, Winsor invention discloses, "The supported nickel material used in the present process may be prepared in any of the known ways and may incorporate any of the known natural or synthetic materials, such as refractory oxides of the elements of Groups II to V of the Periodic Table" (Page 2, lines 72-77).

Winsor also discloses treatment with sulfur-compounds comprising Class A and Class B compounds including thiophenes having 4-10 carbon atoms (See page 3, lines 38-61). It is to be noted that thiophenes having 4-10 carbon atoms encompass aromatic sulfur compounds.

Winsor invention does not appear to specifically disclose the details of preparing nickel adsorbent.

Bouwman discloses preparation of sulfur-promoted nickel catalyst on alumina (See title and abstract). Bouwman also discloses preparation of nickel catalyst by co-precipitating it with sulfur compounds including sulfides and thiophenes (See column 3, lines 17-54).

In view of Bouwman's teaching, it would have been obvious to one with ordinary skill in the art at the time of invention to specify the details of preparing nickel adsorbent in Winsor invention which is expected to be similar to the steps as disclosed by Bouwman.

Winsor does not appear to specifically disclose nickel adsorbent obtained by treating a metallic nickel adsorbent.

Archibald discloses a process of desulfurization of hydrocarbons with a mixture of Group VIII metal and Group VIII metal oxide or sulfide (See title) similar to Winsor. Archibald also discloses producing nickel adsorbent by treating a metallic nickel adsorbent (See column 3, lines 4-9).

In view of Archibald teaching, it would have been obvious to one with ordinary skill in the art at the time of invention to modify Winsor invention and use nickel as metallic nickel adsorbent without a support as disclosed by Archibald and reduce the total volume of adsorbent and make the contacting device more compact.

9. With respect to claims 29 and 30, Winsor invention discloses, "The supported nickel material used in the present process may be prepared in any of the known ways and may incorporate any of the known natural or synthetic materials, such as refractory oxides of the elements of Groups II to V of the Periodic Table" (Page 2, lines 72-77). It is to be noted that silicon belongs to Group IV A. It is also to be noted that co-precipitation, calcining and reduction of the catalyst are standard and routine steps used in the preparation of the adsorbent (See Bouwman, column 3, lines 17-54).

10. With respect to claim 33, Archibald invention discloses oxide of the metal in the nickel adsorbent (See column 2, lines 33-35).

11. With respect to claims 42-45, Archibald invention discloses treating the metallic nickel adsorbent at a temperature of 260°F (127°C), calcining at 800°F (427°C) and reducing the metallic nickel by treating with hydrogen at a temperature of 800°F (427°C) See column 3, lines 18-33). Archibald also discloses use of porous adsorbent along with partially oxidized Raney nickel (See column 3, lines 4-17). It is expected that the disclosed adsorbents act as structural promoter.

***Response to Arguments***

12. Applicant's arguments filed 10/14/2011 have been fully considered but they are not persuasive.

13. In the arguments on page 6-9, the Applicant argues that:

Winsor, which relates to a process for desulfurization of an aromatic hydrocarbon-containing fraction, Brahma, which relates to a catalyst for hydrogenation with an improved resistance against deactivation by sulfur compounds, and Kimber, which relates to a method of testing a heterogeneous or homogeneous catalyst, taken alone or in combination, fail to disclose, teach or

suggest at least this feature as recited in independent claim 25. Applicants' representative asserts that contacting the feed stocks with metal oxides before using the sulfide nickel adsorbent is different from the process as recited in independent claim 25, which requires the oxide of a metal to contact a feedstock *while contacting the feedstock with the nickel adsorbent*. Unlike the process of independent claim 25, which requires the metal oxide to contact the feedstock at the same time as contacting the feedstock with a nickel adsorbent, Winsor clearly requires the cobalt and molybdenum oxides to be used before feedstock is desulfurized. Moreover, Winsor describes that the hydrodesulfurization catalyst removes contaminating sulfur compounds by converting them to hydrogen sulfide. *See p. 2, lines 41-43.* This is completely different to the process as recited in independent claim 25, where the metal of the metal oxide adsorbent forms a stable sulfide compound with the contaminating Sulfur compounds. A person having ordinary skill in the art would not obtain claim 25 from Winsor because the processes are distinctly different. Brahma does not remedy the aforementioned deficiencies of Winsor. Brahma describes a process for hydrogenation and/or dehydrogenation using a hydrogenating component with a metal oxide in either two beds or a mixed bed. Brahma also suggests that sulfur compounds are hydrogenated by a hydrogenated compound releasing sulfur atoms, which react with a metal oxide to form a metal sulfide. *See col. 4, lines 10-20.* Claim 25, on the other hand, describes a process for removing sulfur compounds without hydrogenating aromatic compounds, such as benzene,

toluene, tetralins, *etc.* Brahma fails to disclose, teach or suggest that the metal oxide can be used to remove contaminating sulfur compounds, such as thiophenes, without aromatic hydrogenation as the process of claim 25. Therefore, the hydrogenation component of Brahma, which hydrogenates hydrocarbons and the nickel adsorbent of claim 25, which does not hydrogenate aromatic hydrocarbons, are not equivalent. The different processes of Winsor and Brahma are distinctly different, since Winsor aims to prevent appreciable hydrogenation of hydrocarbons (*see* Winsor at p. 1, lines 50-53), while Brahma aims to improve the hydrogenation of hydrocarbons (*see* Brahma at col. 1, lines 39-42), therefore no person having ordinary skill in the art would find that combining the processes of Winsor and Brahma flows logically. Kimber fails to remedy the aforementioned deficiencies of Winsor and Brahma.

In response, it is the examiner's position that Winsor discloses contacting the feed stock in presence of hydrogen with a sulfided nickel adsorbent (See page 1, lines 23-36, 60-61). Winsor also discloses contacting the feedstock with metal oxides (cobalt and molybdenum oxides) for the removal of contaminating sulfur compounds before using the sulfided nickel adsorbent from the hydrocarbon feedstock (See page 2, lines 30-45).

Brahma discloses a hydrogenation process in which the particles of metal oxide (cobalt and molybdenum oxides) containing component and the particles of hydrogenation component (nickel) can be applied to the same support material or onto

different support materials and then mixed with each other (See column 2, lines 43-53, 60-67; column 3, lines 1-13; column 4, lines 4-9).

Bailey discloses that a commercially available nickel hydrogenation catalyst can also be used as a desulfurization adsorbent (See Examples 1-2, column 5; Example 5, column 5). Thus, Bailey is evidence that the nickel adsorbent used in Brahma invention is also a desulfurization adsorbent

In view of Brahma/Bailey teaching, it would have been obvious to one with ordinary skill in the art at the time the invention was made to modify Winsor invention and use the metal oxides along with nickel adsorbent mixed together for an enhanced desulfurization effect. According to MPEP, "It is *prima facie* obvious to combine two compositions each of which is taught by the prior art to be useful for the same purpose, in order to form a third composition to be used for the very same purpose". *In re Kerkhoven*, 626 F.2d 846, 850, 205 USPQ 1069, 1072 (CCPA 1980). It is again emphasized here that nickel adsorbent used as a hydrogenation catalyst by Brahma has been used as a desulfurization adsorbent in the combined Winsor/Brahma/Bailey invention.

Kimber reference has been used to teach catalyst activity test (See column 1, lines 49-68; column 2, lines 1-38).

14. In the arguments on page 10, the Applicant argues that Bouwman and Archibald do not cure the deficiencies of Winsor/Brahma/Kimber and also do not disclose claim 25.

In response, it is the examiner's position that Bouwman reference has been used for its teaching on preparation of sulfur-promoted nickel catalyst (See column 3, lines 17-54). Similarly, Archibald has been used for its teaching on nickel adsorbent produced by treating a metallic nickel adsorbent (See column 3, lines 4-9).

15. In conclusion, the claimed invention is *prima facie* obvious over combined teachings of Winsor, Brahma, Bailey, Kimber, Bouwman and Archibald.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Prem C. Singh whose telephone number is 571-272-6381. The examiner can normally be reached on 7:00 AM to 3:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenn Calderola can be reached on 571-272-1444. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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